

Long-term Life Recovery Processes Among Survivors of the 1995 Kobe Earthquake: 1999, 2001, 2003, and 2005 Life Recovery Social Survey Results

Shigeo Tatsuki

Professor, Department of Sociology, Doshisha University
Kamigyo-ku, Kyoto 602-8580, Japan
E-mail: tatsuki@gold.ocn.ne.jp

[Received September 25, 2007; accepted December 4, 2007]

This paper summarizes findings from life recovery surveys conducted in 1999, 2001, 2003, and 2005 among 1995 Kobe earthquake survivors. The 1999 survey (N=915) developed some of the key scales for the project, including life recovery, physical and psychological stress, family relations, and civic-mindedness. The 2001 study (N=1203) integrated 1999 study findings and those from 1999 grassroots assessment of life recovery, from which a seven critical element model of life recovery was constructed. The effects of these seven critical elements on life recovery were empirically tested and validated by general linear model (GLM) analysis. The 2003 (N=1203) and 2005 (N=1028) studies focused both on life recovery outcomes and on intervening life recovery processes. Structural equation modeling (SEM) identified causal links among recovery-promotion factors, recovery processes such as event impact stabilization, and event evaluation through community empowerment, and recovery outcomes. Event impact was a process through which impact caused by earthquake damage, loss, and/or stress was alleviated by housing, household finances, and stress management. Through event evaluation, social ties and community rebuilding efforts directly or indirectly facilitated the reframing of earthquake experiences into positive narratives. Research and policy implications of these findings are discussed in the end.

Keywords: The 1995 Kobe earthquake, social survey, long-term life recovery, GLM, SEM

1. Introduction

This paper summarizes major findings from the Hyogo Life Recovery Survey Project, a series of four consecutive cross-sectional social surveys, in order to study long-term life recovery processes among 1995 Kobe earthquake survivors. The first survey was conducted in 1999, five years after the Kobe earthquake. Questionnaires were repeatedly administered to those who resided in the same 330 affected areas out of which ten respondents were randomly selected each time in

2001, 2003, and 2005.

The research framework evolved in three stages over the project's seven-year period. The first stage was exploratory because no preceding long-term life recovery model applicable to an urban mega-disaster (Kawata, 1995 [1]) existed either nationally or internationally. The first survey, administered in March 1999, was designed to develop several key scales that could be repeatedly used in subsequent surveys. Among these measures, an important development was that of life recovery, which was designed to quantify the dependent variable for the project. The 1999 survey also examined demographic, disaster impact, and social characteristics of those who showed a higher level of life recovery (Tatsuki and Hayashi, 2000 [2]). The second stage integrated findings from the 1999 study and from the grassroots assessment workshop on life recovery conducted in summer 1999 (Tatsuki and Hayashi, 2001 [3]); refer also to the article by Tamura in this issue). Based on these findings, the seven critical element model of life recovery was constructed. This model guided research framework building for the 2001 Hyogo Life Recovery Survey. The third stage refined the research strategy that was then used in the 2003 and 2005 surveys. These two surveys focused on both life recovery outcomes and intervening life recovery process variables. The 2003 survey resulted in the construction of the long-term life recovery process and outcome model from a mega-disaster (Tatsuki et al, 2004 [4]). The 2005 survey together with the 2003 and 2004 grassroots assessment workshops conducted in Kobe and southern Hyogo areas (Tatsuki, 2004 [5]) confirmed, in general, both internal and external validity of the final life recovery process and outcome model.

1.1. Preceding Studies on the Recovery Process in Japan and the US

Based on ethnographic interviews (cf., Shigekawa and Hayashi, 1997 [6]) of Kobe earthquake victims in Nishinomiya, Aono, Tanaka, Hayashi, Shigekawa, and Miyano (1998 [7]) found three distinctive timeframes in victim disaster response behavior. This provided the basis for subsequent quantitative analysis that

incorporated the “normalcy-to-disaster-to-recovery” pattern model using macro level time-series statistics such as regional power consumption (Takashima and Hayashi, 1999 [8]) and Kobe city monthly reports on household and socioeconomic activity statistics (Karatani, Hayashi, and Kawata, 2000 [9]).

Webb, Tierney, and Dahlhamer (2000 [10]) summarized results from four large cross-sectional post-event sample surveys on short- and long-term business recovery after major disasters such as the Loma Prieta earthquake in 1989, Hurricane Andrew in 1992, Midwest floods in 1993, and the Northridge Earthquake in 1994. They observed differential impacts upon business recovery due to disaster severity, business size, the degree of operational problems such as disruptions in supply, and employee-related problems, and damage to the surrounding areas that provide the business customer base.

Based on numerous longitudinal/ethnographic interviews with disaster-hit small business owners and NGO leaders, Alesch, Holly, Mittler, and Nagy (2001) [11] pointed out the five most critical variables for long-term recovery: a) the disaster’s impact on the organization’s clientele; b) the availability of convenient substitute goods or services; c) pre-disaster major trends in the organization’s industry, and the individual organization’s position in relation to these trends; d) the extent of financial resources lost by the organization; and e) the owner/operator’s ability to adapt to the new business environment. These points appear to correspond closely to those reported by Webb et al. (2000). Alesch et al. (2001) [11] noted common narratives repeated during interviews across different disaster sites. These included misplaced confidence, an illusion of security, a feeling of helplessness to change outcomes, a continuing nightmare, self-imposed limits on recovery efforts, imprudent use of financial resources, failure to discern changes in customer bases, an assumption that circumstances would return to normal, special impact on retirement age people, and a lack of short-term help. These common narratives appeared to reflect victims’ view of reality and the outside world, which in return may have strongly influenced what they did or did not do (see also Alesch, 2001 [12] and Alesch and Holly, in press [13]).

Although the above studies appear to reflect the current state of the art on the study of long-term recovery in Japan and the US, they do not appear to have fully responded to and/or solved some of the research issues raised at the 1996 Boulder workshop session “What is known and trends for improving recovery and reconstruction following disasters,” in which Joanne Nigg, Trish Bolton, Claire Rubin, and Phil Berke participated as panelists. Dennis Wenger, who moderated the session, summarized the discussion as follows: a) There exists a “need to shift the conceptualization of recovery from linear and outcome-based to seeing it as an ongoing and long-term process;” b) antecedent recovery studies tend to be

“overly descriptive, fragmented, and short-term oriented;” c) not much attention has been paid to link a disaster response phase to a recovery phase; and d) more research is needed to understand the long-term effects of disaster recovery (Wenger, Rubin, Nigg, Berke, and Bolton, 1996 [14]).

1996 Boulder workshop session participants agreed that an attempt should be made to overcome “overly descriptive, fragmented, and short-term oriented” studies by incorporating large systematically sampled surveys. The aforementioned quantitative studies (e.g., Webb, Tierney and Dahlhamer, 2000 [10]) are cross-sectional, linear, and outcome-based at best, and thus do not fully pay attention to ongoing recovery processes. In comparison, long-term, longitudinal, and ethnographic studies on disaster victims provided rich insights about recurring themes (e.g., Shigekawa and Hayashi, 1997 [6]; Aono, Tanaka, Hayashi, Shigekawa and Miyano, 1998 [7]); Alesch and Holly, in press [13]). Their insights have not yet been fully verified by either long-term large sample surveys or by those based on individual as opposed to aggregate data sources.

2. 1999 Study

The 1999 Hyogo Life Recovery Survey aimed to identify determinants of changes in residence and life reconstruction among 1995 Kobe earthquake victims. Based on findings from preceding ethnographic research (Aono, Tanaka, Hayashi, Shigekawa, and Miyano, 1998 [7]; Tanaka, Aono, and Hayashi, 1998 [15]; Tanaka, Hayashi, and Shigekawa, 1999 [16]), the questionnaire was designed to inquire about residence locations, sources of help, a sense of civic-mindedness, and family relations at the 10th, 100th, and 1000th hour and at six months after the earthquake. These time points were considered to correspond to critical boundaries that segmented phases of disaster victims’ behavior. For details on residence relocation patterns and their determinants, see Kimura’s article in this issue. Regarding the purposes of the current paper, the 1999 study should be noted as the first attempt to construct standardized measures of life recovery, physical and mental stress, civic-mindedness, and family relations. These measures were to be repeatedly used in the three subsequent surveys.

2.1. Methods

2.1.1. Respondents

A random sample mail survey was conducted on 3,300 earthquake victims who experienced severe life difficulties due to the 1995 Kobe earthquake. The sample was divided into two groups. One consisted of those who stayed within Hyogo prefecture: 2,500 Hyogo residents were sampled from 250 randomly selected points with a seismic intensity of 7 and/or with a more

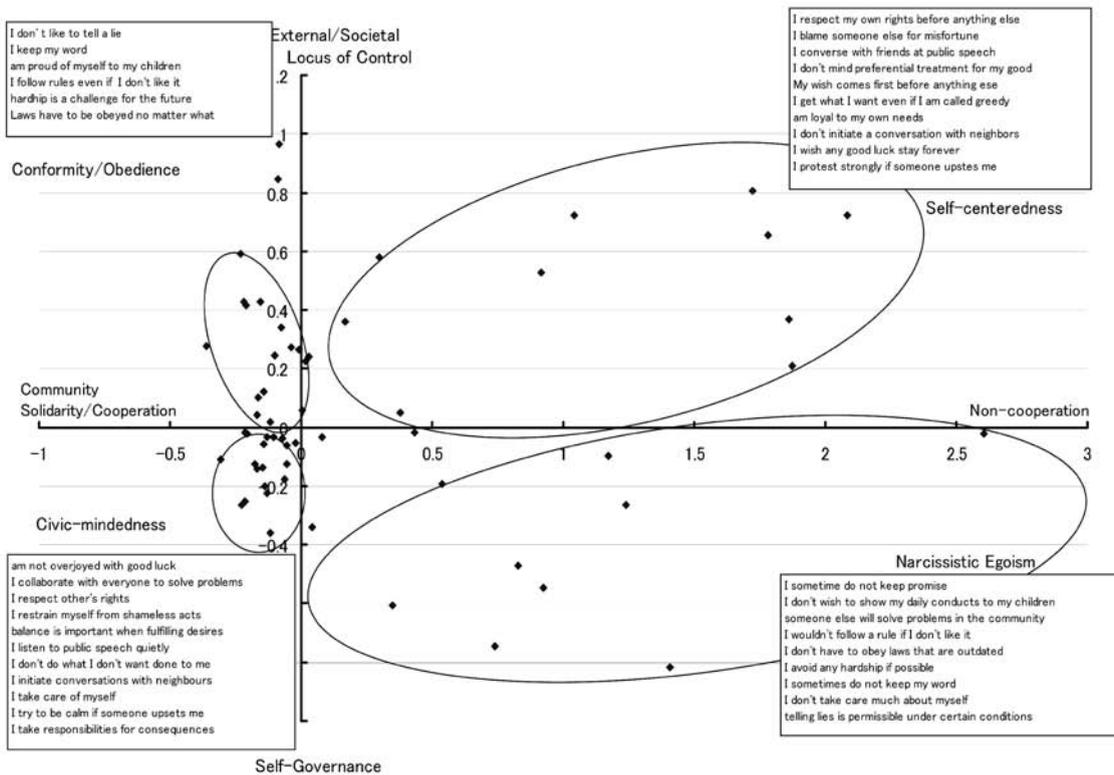


Fig. 1. Dual Scaling analysis of 1999 study civic-mindedness scale items.

than two month cutoff from the city gas supply. The other group consisted of those who left Hyogo prefecture: 800 Hyogo residents who left the prefecture were randomly selected from the subscribers' list for a Hyogo Government newsletter aimed at Hyogo victims leaving the prefecture. 3,300 questionnaires were mailed at the beginning of March 1999 and 993 (683 Hyogo and 313 Hyogo residents who left the prefecture) were returned by the end of March. Of these, 915 responses (623 or 25.7% from Hyogo and 292 or 37.1% from outside of Hyogo) were valid.

2.1.2. Instruments

Based on findings from preceding ethnographic research, the questionnaire was designed to inquire about life environments at the 10th, 100th, and 1000th hour and month 6 after the earthquake. These time points were found to correspond to critical boundaries that segmented phases of disaster victim behavior (Tanaka, Hayashi, and Shigekawa, 1999 [16]). The questionnaire included the following four scales that measured family functioning, civic-mindedness, physical and psychological stress, and life recovery.

The family functioning scale is a 16-item Thurstone scale, which measures the two critical dimensions of family relations, family adaptability and cohesion (Olson, Russell, and Sprenkle, 1979 [17]; Tatsuki, 1999 [18]). Family adaptability is defined as a family system's

ability to change its power structure, role relations, and relationship rules in response to situational and developmental stress. Family cohesion is the emotional bonding that family members feel to each other. Normally, moderate family adaptability and cohesion is optimal; too much or too little is considered dysfunctional. However, Families are known to become extreme on either dimension in order to adjust to crisis situations.

The civic-mindedness scale is a 20 question trichotomous instrument that measures self-governance and community solidarity. This scale was specifically developed for the 1999 study based on conceptual clustering of the preceding literature on civil society and civic-mindedness (Rousseau, 1913/1762 [19]); Kline, 1994 [20]; Burchell, 1995 [21]). Each dimension is bipolar. The self-governance dimension contrasts valuation based on internal criterion (self-governance) with that based on external/societal criterion. The community solidarity dimension contrasts cooperation (community solidarity) with non-cooperation. For each of 20 items, respondents chose one of the bipolar options on either dimension or a neutral answer ("cannot decide either").

The physical and psychological stress scale consists of 6 physical and 6 psychological stress items selected from 111 stress symptom items part of the 1995 Japan Red Cross Stress Study (Hayashi, Nishio, Sugawara,

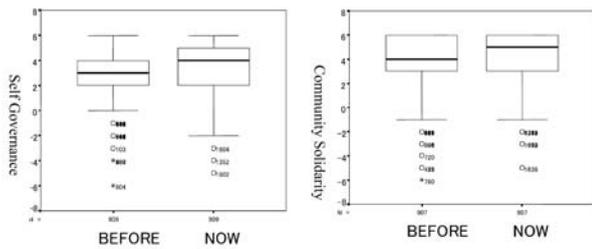


Fig. 2. Changes in civic-mindedness pre- & post-earthquake: Results from the 1999 Hyogo life recovery survey (1) (N=993).

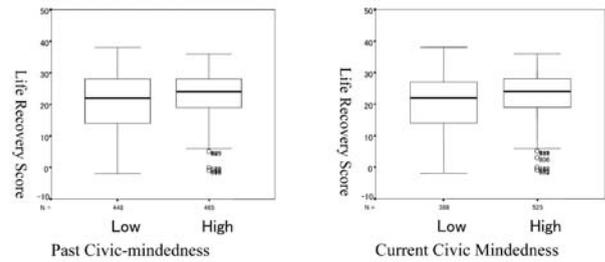


Fig. 3. Level of civic-mindedness by degree of recovery: Results from the 1999 Hyogo life recovery survey (2) (N=993).

Monma, Kohno, Makishima, Numata, and Nemoto, 1996 [22]). Factor analysis with a varimax rotation of these 12 items in original Japan Red Cross Study data showed a clear two factor simplex structure with psychological stress on the first factor and physiological stress on the second.

The life recovery scale is a 14 item 5-point Likert scale that asks subjective evaluations of life fulfillment compared to pre-earthquake days, life satisfaction, and future prospects. 7 items ask the degree of life fulfillment in such areas as daily living, work, the meaning of life, social life, enjoyment, hope, and liveliness of everyday life. 6 life satisfaction items inquire about satisfaction in everyday life, health, human relationships, household finance, family life, and work. One item was used to ask about prospects in the respondent's life one year from now.

2.2. Results

Family Relations. During an emergency, family system adjustment to earthquake turmoil was characterized by closer family ties (high family cohesion) and by clear parental leadership (i.e., low family adaptability). The majority of families, however, did not stay at the same level and returned to a more balanced level between 1,000 hours and month 6: Respect for individuality and autonomy (i.e., lowered cohesion) and for more democratic leadership structure (i.e., more balanced adaptability) were recovered. Families that reported a balanced level of cohesion and adaptability during recovery were the most functional in promoting individual recovery and in alleviating stress. For details on findings, see Tatsuki and Hayashi (2000 [2]).

Adaptive construction of new reality: A rise of civic-mindedness. Dimensions of a civic-mindedness scale. In order to identify basic dimensions of civic-mindedness, 20 trichotomous questions were asked. Dual scaling analysis (Nishisato, 1980 [23]) was conducted on responses to these questions. The most dominant solution was a pattern of "cannot decide either" and second and third response patterns were used for further analysis. A scattergram (**Fig. 1**) displays item

weights for the second (horizontal axis) and the third (vertical axis) solutions. The second solution differentiated between community solidarity/cooperation (left) and non-cooperation (right) orientation. The third solution differentiated between external/societal-criterion-based (top) and self-governance (bottom) valuation.

Based on these two axes, items were clearly grouped into four quadrants. The first quadrant or the top right corner was termed self-centeredness, which was characterized by high non-cooperation and high external criterion-based valuation. Self-centeredness items included such wording as "respect my own rights before anything else," "blame someone else for misfortune," "converse with friends at public speeches," and "don't mind preferential treatment for my benefit."

While self-centeredness depends on others to feel better or one-up on others, narcissistic egoism (bottom right quadrant) depends on the individual's value system alone. Narcissistic egoism items included such wording as "sometimes do not keep promises," "won't follow rules if I don't like them," and "avoids hardship if possible."

The top left quadrant was termed conformity/obedience, characterized by high community solidarity and high external/societal valuation. Conformity/Obedience items included such wording as "don't like to tell a lie," "keep my word," "follow rules even if I don't like them," and "hardship is a challenge."

In contrast to conformity/obedience, civic-mindedness, in the bottom left quadrant, was characterized by high self-governance and high community solidarity. Civic-mindedness items included such phrases as the following:

Self-governance

1. Am not overjoyed with good luck
2. I restrain myself from shameless acts
3. I try to be calm if someone upsets me
4. Balance is important when fulfilling desire
5. I take care of myself
6. I try to keep my word

Community Solidarity

1. I collaborate with others to solve problems

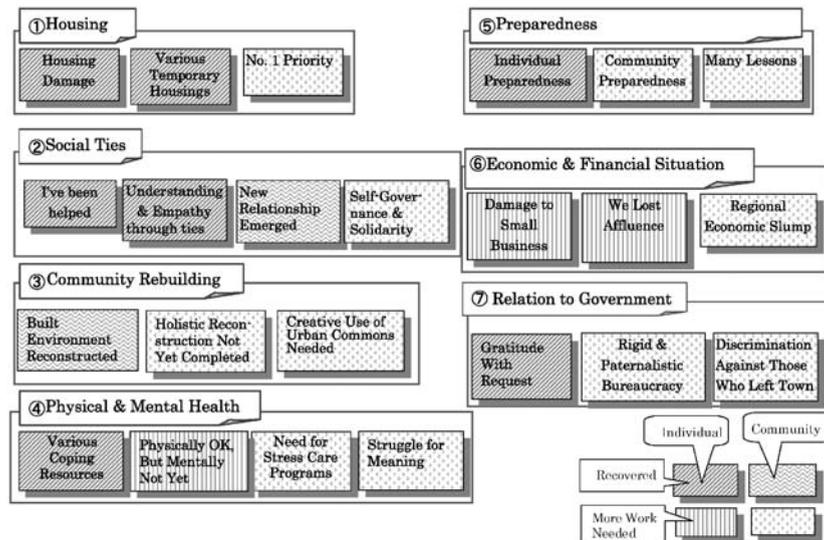


Fig. 4. Seven critical elements for life recovery (Jul. to Aug., 1999).

2. I respect others' rights
3. I listen to public speeches quietly
4. I do unto others as I would have done to me
5. I initiate conversations with neighbors
6. I take responsibility for consequences

Reflection on pre- to post-earthquake changes in civic-mindedness. Respondents were requested to evaluate their sense of civic-mindedness before and after the earthquake. Responses from the 6 self-governance and 6 community solidarity items above were added and scores obtained, respectively. Fig. 2 indicates that both self-governance (left) and community solidarity (right) scores increased from pre- to post-earthquake occasions. Note that although separate scores were obtained from each of the other three quadrants of self-centeredness, narcissistic egoism, and conformity/obedience, no apparent change was observed from pre- to post-earthquake times among these scores. The adaptive nature of the changed worldview on society is detailed in Fig. 3, which shows that those who reported high civic-mindedness (a sum of self-governance and community solidarity scores) post-earthquake tended to recover better from the disaster (left) and were less stressed (right) than those who reported low civic-mindedness. These findings suggest that earthquake disaster experience caused many survivors to change their internal value system, that they constructed a new civic-minded worldview as a result of adaptation to a new environment, and that these changes in civic-mindedness were responsible for elevating both their subjective evaluation of life recovery and their coping with life stressors.

The 1999 Life Recovery Survey was exploratory and developmental in nature. Four sets of scales developed showed empirical evidence for continued use. An operational measure of life recovery was developed first,

involving a 14-item life recovery scale covering three related but conceptually different areas – a level of life fulfillment compared to pre-earthquake, life satisfaction in current daily life, and prospects. This scale was repeatedly used in the three subsequent surveys as a dependent/criterion measure. A Japanese version of Family Adaptability and Cohesion Evaluation Scale demonstrated predicted relations with individual life recovery: Those who enjoyed functional family relationships showed significantly higher life recovery. Third, a physical and mental stress scale developed demonstrated clear relations to both life recovery and family functioning. Fourth, a concept of civic-mindedness was constructed as a predictor of life recovery and its operationalized measure was developed. The 1999 survey found a rise in civic-mindedness among people from pre- to post-earthquake. Those high in self-governance and/or solidarity, two dimensions of civic-mindedness, reported higher life recovery and lower physical or mental stress (Tatsuki and Hayashi, 2000 [2]).

3. 2001 Study

The research frame development for the 2001 study was guided by 1999 study results and by findings that were obtained through a series of grassroots stakeholder assessment workshops on life recovery conducted during summer 1999 (Kobe City Research Committee on Disaster Recovery, 2000 [24]); Tatsuki and Hayashi, 2001 [3]). The assessment identified major factors determining life recovery among those who experienced damage and loss during and after the 1995 Kobe earthquake. Residents from all of Kobe's nine wards and three special interest groups provided assessments of life recovery at grassroots workshop sessions. This yielded

Table 1. Overview of 2001 study independent and dependent scales.

Scale	Description
Housing	Relocation due to the earthquake
Social Ties	Self-Governance, Community Solidarity, Community Participation, Social Trust, Family Cohesion and Adaptability
Community Rebuilding	Awareness of Urban Commons
Physical and Psychological Health	Physical and Mental Stress Symptom Checklist, General Health Practices Index
Preparedness	Awareness/Preparedness for the next major earthquake
Economic/Financial Situation	Increase/Decrease in Household Income, Expenditure, and Savings
Relation to Government	Paternalistic, Liberal, and Communitarian Views of Government, Willingness to Pay (WTP)
Life Recovery	Life fulfillment, Life satisfaction, One year prospect
Social Desirability	MMPI Lie Scale

1,623 opinion cards which were taken back to the laboratory, where conceptual clustering was attempted, creating seven mutually exclusive supercategories – housing, social ties, community rebuilding, physical and mental health, preparedness, economic and financial situation, and relation to government. Each supercategory was divided into subcategories evaluated on two dimensions: whether they refer to an individual or a community as a whole and whether it was recovered or more work was needed. **Fig. 4** shows color-coded assessment results for subcategories within each supercategory or life recovery element. For details on the 1999 grassroots assessment workshop, see Tamura’s article in this issue.

The 2001 study aimed to develop valid and reliable scales for the seven critical life recovery elements. The scale construction strategy was guided by elaborating which subcategories were judged to be “more work needed” within each supercategory. “Number one priority,” for example, was placed to solve issues related to housing. Relocation experience due to the earthquake was used as a measure of housing. Because more work was needed to empower self-governance and solidarity in social ties, further item selection and refinements were attempted in the 1999 study product civic-mindedness scale. For data analysis, the 2001 study conducted a general linear model or GLM analysis to determine which variables or what combinations of variables best predicted life recovery outcome among citizens.

3.1. Methods

3.1.1. Respondents

In January 2001, 3,300 questionnaires were mailed to adults over the age of 20 who resided in the Kobe-Hanshin region at the time of the 1995 Kobe earthquake, and 1,203 valid responses were returned (36.5%). It had been intended that the same respondents who participated in the 1999 survey would again be

studied in the 2001 survey, but due to confidentiality requirements by the Hyogo Prefecture government commissioning the four consecutive surveys, it became clear that mailing new questionnaires to the same respondents would violate the prefecture’s privacy protection policy because of the lack of signed consent from 1999 survey participants. For the 2001 survey, ten new respondents were sampled from each of the same 250 research points that the 1999 study used, and 80 extra points in the Northern and Western wards of Kobe were included. These two wards were the only two out of nine wards not surveyed in the previous 1999 survey. Residents at these new points did not experience as devastating an earthquake impact as residents at the other 250 points, but suffered from the same degree of socioeconomic impact as those residing in the rest of the Kobe-Hanshin region. Like the other 250 points, ten respondents were randomly selected from each of the new 80 points. Efforts were also made to ensure a gender balance. The 1999 study surveyed heads of households. This caused the sample to be unequally male-dominated in the 1999 study data. The 2001 survey targeted men and women over the age of 20 to ensure a gender balance.

3.1.1. Instruments

The 1999 grassroots assessment proposed seven critical elements that determined life recovery among Kobe earthquake survivors. Scales/items were constructed to capture each of these elements. These scales/items were designed as predictor variables in research design. For the criterion/dependent variable, the life recovery scale constructed in the 1999 survey was used for the current study (**Table 1**).

Life Recovery. The life recovery scale consists of 14 five-point Likert scale items that asked about 1) the fulfillment of daily activity, social relationship, subjective well-being compared to pre-earthquake days (7 items); 2) life satisfaction (6 items); and 3) one year

prospect (1 item). These 14 items were originally developed in the 1999 Kobe survey and showed unidimensionality with high reliability (Cronbach's alpha was .91) (Tatsuki and Hayashi, 2000 [2]).

Housing. A measure of housing for the 1999 study was whether respondents experienced relocation due to earthquake damage. It was postulated that relocation made housing one of the most important critical elements in the 1999 grassroots assessment workshop. The study prepared other measures for housing, including how settled respondents felt at their places, types of current housing, and the structure of housing units. It became evident in GLM analysis that relocation experience was one of the best housing element indicators and the rest did not provide much empirical support to qualify them for housing variables.

Social Ties. The civic-mindedness scale is an 8 question dichotomous instrument measuring self-governance and community solidarity. This scale was originally developed for the 1999 study and was based on conceptual clustering of preceding literature on civil society and civic-mindedness (Tatsuki and Hayashi, 2000 [2]). The scale's content dimensions were then qualitatively cross-validated by the 1999 grassroots assessment workshop on life recovery. For the 2001 study, 8 items were further selected from the original 20 item civic-mindedness scale based on face validity analysis of original items. Changes were also made from trichotomous to dichotomous response options. A neutral answer option ("cannot decide either") was excluded in the hope for controlling response biases toward moderate answers. Each dimension is bipolar. The self-governance dimension contrasts a strong sense of individuality/self-control (self-governance) with a weak sense of individuality/self-control. The community solidarity dimension contrasts cooperation (community solidarity) with non-cooperation. For each of the 8 items, respondents chose one of the bipolar options for either dimension.

Four items were prepared to ask the level of community participation. One yes-no answer item asked about participation in neighborhood clubs and associations. Three items questioned the degree of involvement in neighborhood events such as festivals and sports days on a 3-point (always, sometimes, never) Likert scale.

Two items measured the degree of social trust, which enables a person to go beyond personal boundaries and communicate with strangers. These items were "Most people are trustworthy" and "Other people may exploit me if I am not careful (reverse item)." These two yes-no items were selected from general social trust scale as reported by Yamagishi (1998) [25].

FACESKGIV-16, a measure of family functioning constructed for the 1999 study (Tatsuki and Hayashi, 2000 [2]) was used in the 2001 study.

Community Rebuilding. The 1999 grassroots assessment concluded that "community feeling"

(MacIver, 1924 [26]) was closely associated with and could be promoted by a sense of communal ownership of things such as favorite neighborhood landscape, street trees, and flowers (Tamura, 1999 [27]). The 1999 grassroots assessment termed these communally owned goods "urban commons" and indicated that richly embedded urban commons facilitate active citizenship for community rebuilding (Maki, Hayashi, Tatsuki, and Takashima, 2000 [28]). For the 2001 study, 11 concrete urban commons were used to estimate motivation toward community rebuilding. Respondents were asked to check their sense of communal ownership toward any of these 11 items. The more respondents sensed communal ownership, the more they were considered as motivated toward community rebuilding.

Physical and Psychological Health. Respondents' judgments of physical and mental health were measured by physical and psychological stress scales consisting of 6 physical and 6 psychological stress items. The scale was identical to that used in the 1999 study. The scale consists of physical and mental stress subscales. The physical stress subscale is a 6 item 5-point Likert scale and its Cronbach's alpha in the 1999 study was .88. The mental stress subscale is a 6 item 5-point Likert scale. Cronbach's alpha in the 1999 study was .91. To measure respondents' general health practices, 8 items were prepared to ask the degree of daily activities such as drinking, physical exercise, smoking, sleep, balanced diet, regular breakfast intake, work hours, and stress symptom awareness (cf., Belloc and Breslow, 1972 [29]).

Preparedness. Respondents were asked about the perceived risk of damage caused by the Nankai-Tohankai earthquake expected to occur in the next 5 years. The 6 item 5-point Likert scale (least probable to most probable) asked about damage such as personal injury or death of significant others, serious housing damage, damage to household income and assets, long recovery time, widespread damage to public facilities, and major changes in community relations.

Economic and Financial Situation. According to macro economic statistics, local economic activities returned to the pre-earthquake level. On a microeconomic level, Kobe citizens often claim that their household financial situations are only 80% of the pre-earthquake level. To identify subjective evaluation of household financial situations, respondents were asked to choose from among increase, decrease, or no change in their household income, expenditures, and savings after the earthquake.

Relation to Government. The 1999 disaster process study showed a significant increase in civic-mindedness among some citizens. The Kobe TQM assessment indicated that other people still maintained a paternalistic view of the government. Okamoto (1997) [30] classified the relation to government into paternalistic, liberal, and communitarian orientations. Based on his model, four questions were asked on how

Table 2. 2001 life recovery survey general linear model analysis results.

Source of Variance	Type III SS	df	MS	F value	p	partial η^2
Corrected Model	702.311	293	2.397	4.360 ***		0.584
Intercept	0.000	1	0.000	0.001 n.s.		0.000
Damage						
House Damage	0.955	3	0.318	0.579 n.s.		0.002
Furniture Damage	2.116	9	0.235	0.428 n.s.		0.004
Economic Damage	2.736	4	0.684	1.244 n.s.		0.005
Demography						
Locality	7.817	16	0.489	0.889 n.s.		0.015
Locality*Economic Damage	81.829	119	0.688	1.251 **		0.141
Sex	0.984	1	0.984	1.790 n.s.		0.002
Generation	15.848	2	7.924	14.415 ***		0.031
Occupation	16.149	9	1.794	3.264 ***		0.031
House Damage*Sex	4.222	3	1.407	2.560 *		0.008
House Damage*Generation*Occupation	69.058	86	0.803	1.461 ***		0.121
①Housing						
Relocation Experience	2.332	1	2.332	4.242 *		0.005
②Social Ties						
Family Cohesion	13.515	3	4.505	8.195 ***		0.026
Family Adaptability	6.925	3	2.308	4.199 ***		0.014
Self Governance	2.263	1	2.263	4.117 **		0.005
Community Solidarity	2.990	1	2.990	5.439 **		0.006
Community Activity Participation	4.827	1	4.827	8.781 ***		0.010
Social Trust	7.947	1	7.947	14.456 ***		0.016
③Community Rebuilding						
Urban Common.s.	2.025	1	2.025	3.684 *		0.004
④Physical and Mental Stress						
Physical Stress	1.114	3	0.371	0.676 n.s.		0.002
Psychological Stress	57.008	3	19.003	34.568 ***		0.102
Physical * Psychological Stress	17.631	8	2.204	4.009 ***		0.034
General Health Practice	7.306	1	7.306	13.291 ***		0.014
⑤Preparedness						
Future Earthquake Damage	3.581	1	3.581	6.515 ***		0.007
⑥Economic/Financial Situation						
Income	17.437	3	5.812	10.573 ***		0.034
Savings	2.473	3	0.824	1.499 n.s.		0.005
Expenditure	2.928	3	0.976	1.776 n.s.		0.006
⑦Relation to Government						
Communitarianism	1.420	1	1.420	2.584 n.s.		0.003
Willingness to Pay	4.291	1	4.291	7.806 ***		0.009
Communitarianism*WTP	1.909	1	1.909	3.472 *		0.004
Social Desirability Bias	2.041	1	2.041	3.712 *		0.004
Error	501.598	910	0.551			
Total	1202	1203				
		0.365				

*** p<.01 ** p<.05 * p<.10 n.s. Not Significant

to enforce garbage separation rules, how to revitalize community activities, how to save lives in major disasters, and how to promote community development. Respondents were also asked how much money and time they were willing to spend to maintain their community. The amount they were willing to pay (WTP) for local park maintenance, community festivals, and neighborhood activities was used as a six-item scale of communitarian orientation.

Social Desirability. Questionnaire surveys are affected by response biases such as social desirability and defensiveness. To estimate and statistically control response bias, 10 yes-no social desirability items were selected from the MMPI lie scale (Oguchi, 2001 [31]).

3.2. Results

Predictor variables in the 2001 study included earthquake hazard, demographic variables, and seven critical elements. Their effects on life recovery scores were examined. Because some predictors were categorical variables such as house damage (fully, half, partial, no damage), gender (male, female), generation (young adult, middle, old), occupation (classified into 10 categories), and household financial situation (increase,

decrease, no change), and other predictors were scaled (e.g., indices for social ties, local commons, preparedness, physical and mental health, relation to government, and social desirability), the General Linear Model (GLM) was used to examine main and interaction effects on life recovery scores.

3.2.1. Damage, Demography, and Damage-by-Demography Interaction

Regarding damage directly or indirectly caused by earthquake hazards (i.e., house, furniture, and economic damage), no main effect was found on life recovery.

Generation and occupation were two of the most significant predictors among demographic variables. Young adults (those in their 20s and 30s) recovered significantly better than those in middle (40s and 50s) or old age (60 and over) ($F_{2, 910}=14.415, p<.01$). Occupation main effect was also significant ($F_{9, 910}=3.264, p<.01$). Those who were in agriculture/fishery, students, and administrative jobs recovered better than those who were unemployed/retired, in blue-collar or sales clerk jobs.

Although damage main effect was not significant, this did not mean that direct or indirect damage had no

impact. As **Table 2** shows, significant locality-by-economic damage ($F_{119, 910}=1.251, p<.05$) and house damage-by-occupation-by-generation ($F_{86, 910}=1.461, p<.01$) interaction effects impacted on life recovery.

Young adults were found to recover better among most occupational categories. Young adults whose houses were fully damaged and who were proprietors, however, had difficulty in recovering their lives. Among those in their 40s or 50s, two groups were found to have difficulty – (1) those whose houses were completely destroyed and who were currently unemployed, and (2) those whose houses were half-damaged and who were proprietors. For those over the age of 60 whose houses were fully, half, or partially damaged, those who engaged in clerical or sales clerk jobs were the least recovered.

3.2.2. Critical Elements

For critical elements identified by the Kobe TQM assessment, all components were entered into the GLM model. All seven critical components turned out to show significant main effects on life recovery, as detailed below.

Housing. Whether one experienced house relocation due to the earthquake was used as a measure for housing. House relocation tended ($F_{1, 910}=4.242, p<.10$) to lower life recovery scores.

Social Ties. The social ties component was measured by 1) civic-mindedness, 2) community participation, 3) social trust, and 4) family functioning (i.e., adaptability and cohesion) scales. Dual scaling (Nishisato, 1980 [23]) was used to scale response options and scaled scores were obtained for each of civic-mindedness and community participation scales. Dual scaling of an 8 item civic-mindedness scale yielded a two-dimensional structure in which 4 items were loaded high on the first dimension and reflected community cohesion, while the other 4 items were loaded high on the second self-governance dimension. Cronbach's alpha for a 4-item community solidarity subscale was .543 while that for the other 4-item self-governance subscale was .147. Community participation items were dual-scaled and the 3 item scale yielded Cronbach's alpha .848. The two item social trust scale was dual-scaled and two item scale showed Cronbach's alpha .411. Last, 8 items for each of family adaptability and cohesion were dual-scaled and scores used to measure family adaptability and cohesion. Cronbach's alpha for family adaptability and cohesion were .916 and .942, respectively.

All variables designated to social ties showed moderate to strong effects on life recovery. These included a sense of civic-mindedness that consists of self-governance ($F_{1, 910}=4.117, p<.05$) and community solidarity ($F_{1, 910}=5.439, p<.05$), the degree of actual community participation ($F_{1, 910}=8.781, p<.01$), and social trust ($F_{1, 910}=14.456, p<.01$).

Family systems also facilitated life recovery. The Circumplex model of marital and family systems defines family cohesion and adaptability as the two major factors deciding family relationship functioning (Olson, Russell, and Sprenkle, 1979 [17]; Tatsuki, 1999 [18]; Tatsuki and Hayashi, 2000 [2]). Those whose family cohesion was characterized by moderate levels of family cohesion ($F_{3, 910}=8.195, p<.01$) and family adaptability ($F_{3, 910}=4.199, p<.01$) reported higher life recovery.

Community Rebuilding. Dual scaling analysis of 11 items for urban commons yielded a two-dimensional structure, where the first dimension contrasted “no” to “yes” and “do not know” and the second dimension contrasted “yes” to “no” and “do not know.” The first dimension was interpreted to reflect “definitive versus non-definitive” attitude, which was a part of response bias. In contrast, scaled values for “yes,” “no,” and “do not know” options in the second dimension appeared linear. Because of this, the second dimension solution was used as the scaled score for urban commons. Cronbach's alpha for urban commons scale was .726 for the current data.

No recovery of everyday life can be sensed in a no-man's land. It was hypothesized that recovery of everyday life was partly attributed to by an increased sense of stake-holdership in local urban commons. A sense of stake-holdership would increase people's involvement in community affairs and help increase a sense of normalcy in community life. GLM analysis results supported this hypothesis and showed that the more respondents were aware of urban commons, the better they recovered ($F_{1, 910}=3.684, p<.10$).

Physical and Psychological Health. Respondents' judgments on their physical and psychological health and the degree of daily health practices were measured by physical stress scale, mental stress scale, and general health practice index, respectively. 6 items measured each of physical and psychological stress. Cronbach's alpha for physical and mental stress scales were .894 and .943, respectively. Respondents' general health practices were measured by 8 item scale. Cronbach's alpha for general health practices was .537.

To detect non-linear relations between stress and life recovery, both stress scores were categorized into four ordered categories using quantiles. Psychological stress was a very strong linear predictor of life recovery ($F_{3, 910}=34.568, p<.01$) – the single most influential predictor of life recovery among all predictors. The GLM model (**Table 2**) accounted for 58.4% of total variance, one sixth of which was accounted for by psychological stress (partial $r^2 = .102$). Physical stress was not found to have a statistically significant impact upon life recovery ($F_{3, 910}=0.676, n.s.$). General linear model analysis showed a significant physical-by-mental stress interaction ($F_{8, 910}=4.009, p<.01$). For those whose psychological stress was very low or moderately low, moderate physical stress further facilitated a sense of life recovery. The degree of general health practices was a

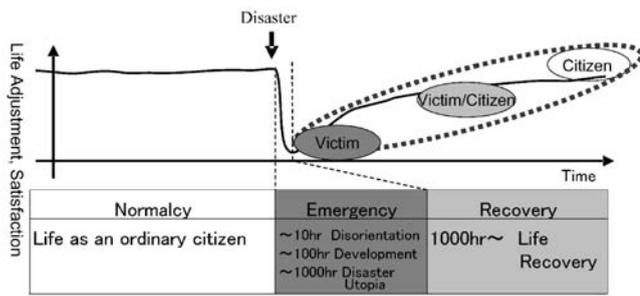


Fig. 5. Normalcy-to-disaster-to-recovery curve model.

significant predictor of life recovery ($F_{1,910}=13.291$, $p<.01$).

Preparedness. The 1999 grassroots assessment suggested that a sense of life recovery was accompanied by the heightened sense of preparedness for disaster. The 2001 panel survey thus asked the degree of damage that respondents anticipated from the predicted Nankai-Tohnankai earthquake. Principal component analysis of the 6 items showed that the first solution accounted for 71.2% of total variance and only the first eigenvalue (4.27) exceeded 1, suggesting a clear unidimensional structure. The 6 item scale yielded Cronbach's alpha .918.

Contrary to the hypothesis, it was found that pessimistic expectation in future disasters – the higher expectation of personal injuries; death of significant others; serious damage to housing, income, and assets; longer time to recovery; and widespread damage to public facilities and community relations – was significantly associated with lower level of life recovery among respondents ($F_{1,910}=6.515$, $p<.01$).

Economic and Financial Situation. Respondents were asked to compare pre-earthquake and current levels of household income, expenditure, and savings. Results showed that changes in income was a significant predictor of life recovery $F_{3,910}=10.573$, $p<.01$). The better off respondents were in income, the better recovery they reported. Savings and expenditures did not, however, predict life recovery.

Relation to Government. 4 trichotomous items were prepared to ask respondents' views of the government in either paternalistic, liberal, or communitarian orientations. Dual scaling analysis of the 4 items revealed a 2 dimensional structure, where the first solution contrasted liberalism versus paternalism and the second solution differentiated communitarian from the other two orientations. Cronbach's alpha for liberalism-paternalism and communitarianism subscales were .362 and .345, respectively. GLM analysis showed that the communitarian subscale only weakly affected life recovery ($F_{1,910}=2.584$, n.s., $p=.105$). In contrast, the six item willingness-to-Pay (WTP) scale for community

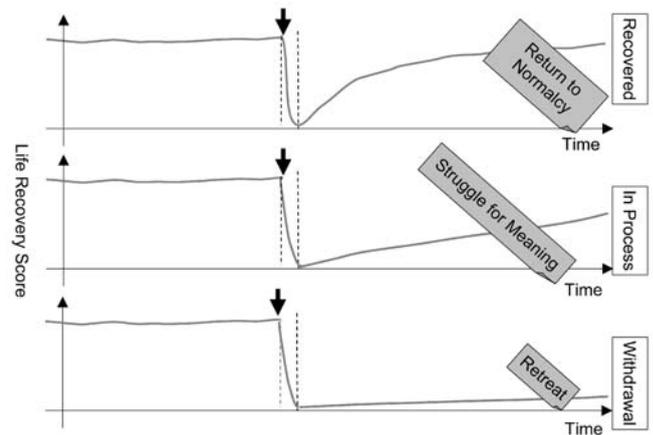


Fig. 6. Three recovery curve typologies.

affairs (Cronbach's alpha.899) was a significant predictor of life recovery. Those who are willing to pay more money and time for community affairs were found to recover better ($F_{1,910}=7.806$, $p<.01$). A trend toward communitarianism and WTP interaction was found ($F_{1,910}=3.472$, $p<.10$), suggesting that communitarians tended to be extraordinarily generous in offering time and money for community affairs.

Social Desirability. The 10 item social desirability scale was unidimensional and its Cronbach's alpha for all 10 items was .536. Social desirability weakly affected life recovery ($F_{1,910}=3.712$, $p<.10$), indicating that part of life recovery variance was weakly explained by the bias of respondents to state their situations as better than they actually were. That proportion as measured by partial r^2 was only 0.4% and thus judged negligible.

4. 2003 and 2005 Study

The current paper's brief review of the literature showed a need to understand recovery as long-term, ongoing, individual processes by incorporating a systematic longitudinal methodology. The 2003 and 2005 Life Recovery Surveys directly examined these issues. Two additional sources of general literature were sought to build working models that conceptualized life recovery as long-term, ongoing, and individual processes. One source was a sociological view of how the reality of everyday life was constructed in transactions in a social context (Berger and Luckman, 1966) [32]. Based on this model, a "normalcy-to-disaster-to-recovery" curve model was constructed (Fig. 5). Three recovery curves were identified by this model, i.e., return to normalcy, struggle for meaning, and retreat (Fig. 6).

The other rich source of previous literature on human recovery was in writings by psychologists and psychiatrists who had worked with holocaust survivors, hibakusha, Vietnam veterans, and dying patients (Frankl, 1959 [33]), Lifton, 1967 [34]); Kubler-Ross, 1969 [35]).

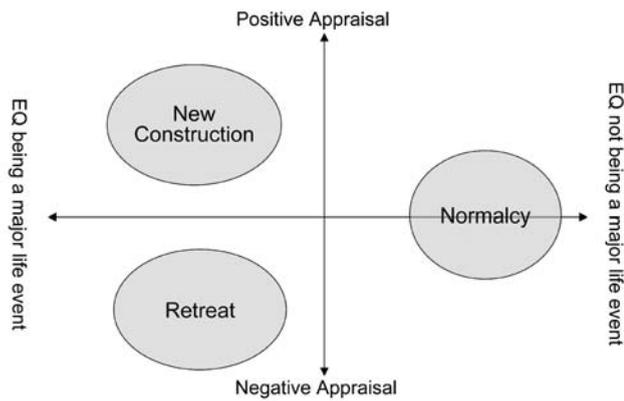


Fig. 7. Two-axis model of life recovery.

Their writings emphasized that victims never regained the same normalcy as before and that what mattered the most was how one reappraised the past event and made sense of it in the “here and now.” Two axes were postulated in this model (**Fig. 7**) – (1) whether the earthquake was conceived to be a major life event (horizontal axis) and (2) whether life change after the earthquake was felt to be positive or negative (vertical axis).

Because of postulations of life recovery processes, 2003 and 2005 studies prepared three distinctively different types of variables: (1) Variables such as the seven critical elements that predicted life recovery processes and recovery outcomes were designated as independent variables. (2) Recovery process variables were constructed as intervening variables that were influenced by independent variables on the one hand and influenced life recovery outcomes on the other. (3) Life recovery outcome measures were treated as dependent variables. The 2003 and 2005 studies used structural equation modeling (SEM) that explained causal links among hazards and demographics, seven critical elements, life recovery processes and their outcomes as reported by 1995 Kobe earthquake survivors.

4.1. Methods

4.1.1. Respondents

The population of the 2003 and 2005 studies was the same as that of the 2001 study, about 2.5 million people who resided in areas hit hardest by the 1995 Kobe earthquake. This included residents in ten cities in the Kobe-Hanshin area and those on Awaji Island. The same 330 points were used. Two independent sets of ten residents over the age of 20 at each point were randomly selected for each study. The 2003 and 2005 questionnaires were mailed in January of 2003 and 2005. Valid responses numbered 1,203 (36.5%) for the 2003 survey and 1,028 (31.2%) for the 2005 study.

Table 3. Overview of seven critical element and life recovery outcome scales for 2003, and 2005 surveys.

Scale	Description
Housing	Housing Satisfaction
Social Ties	Self-Governance and Community Solidarity, Community Participation, Social Trust, Family Cohesion and Adaptability
Community Rebuilding	Awareness of Urban Commons
Physical and Psychological Health	Physical and Psychological Stress Scale
Preparedness	Awareness/Preparedness for the next major earthquake, Personal, Community and Public Preparedness and Mitigation, Predicted Damage due to expected Toka and Tonankai earthquakes
Economic/Financial Situation	Increase/Decrease in Household Income, Expenditure, and Savings
Relation to Government	Paternalistic, Liberal, and Communitarian Views of Government, Willingness to Pay (WTP)
Life Recovery Outcome	Life satisfaction, Fulfillment of Everyday Life, One Year Prospect

Table 4. Overview of life recovery curve and life change appraisal model scales.

Scale	Description
Recovery Curve	Return to Normalcy, Struggle for Meaning, Retreat
Life Change Appraisal	Sense of Life Change, Life Change Direction

4.1.2. Instruments

Questionnaire items were divided into four categories – sociodemographic and damage variables, seven critical life recovery element variables (Tatsuki and Hayashi, 2002 [36]), life recovery process variables, and life recovery outcome variables.

Sociodemographic and damage. The following variables were asked in the questionnaire: age, gender, job, family members, types of housing, house damage, household goods damage, lifeline damage, and economic damage. For the final analysis, house damage and household goods damage responses were optimally scaled and their scores were used.

Seven critical element and recovery outcome variables. Variables used in the current study (**Table 3**) were based on the 1995 grassroots workshop results (Tamura, Hayashi, Tatsuki, and Kimura, 2001 [37]) and GLM analysis of the 2001 Kobe life recovery survey study (Tatsuki and Hayashi, 2002 [36]).

Life recovery process model variables. **Table 4** summarizes the recovery curve model and life change appraisal model variables. Recovery curve model variables included return to normalcy, struggle for meaning, and retreat. Those for life change appraisal model were a sense of sense of life change and life change directions.

4.2. Results

4.2.1. Integration of Life Recovery Process Models

Tables 5 and 6 show factor analysis results of 17 (2003 study) and 13 (2005 study) recovery curve and five life change appraisal items. Both result clearly

Table 5. 2003 study factor analysis results of 17 recovery curve and 5 life change appraisal model items (promax rotation).

Items	Retreat	Struggle for Meaning	Sense of Life Change	Return to Normalcy	Life Change Direction	Communality
I don't want to be asked about my EQ experiences.	0.842	-0.134	0.026	-0.138	-0.145	0.719
I don't want to listen to EQ stories	0.828	-0.177	0.004	-0.116	-0.165	0.691
I don't want to recall EQ episodes.	0.806	-0.119	0.114	-0.072	-0.208	0.659
I want to erase EQ experiences from my past.	0.716	-0.101	0.208	-0.049	-0.212	0.552
I have had little emotionally moving experience after EQ.	0.669	-0.226	0.130	-0.138	-0.228	0.469
I have become indifferent about my fate.	0.577	-0.254	-0.051	0.063	-0.259	0.380
I don't talk about EQ experiences anymore.	0.453	-0.186	-0.382	0.019	-0.083	0.385
I feel strongly that living a life has a meaning.	-0.249	0.738	0.043	0.137	0.259	0.567
I think that there is a meaning in my life.	-0.200	0.706	0.040	0.060	0.215	0.520
I have emotionally grown thanks to EQ experiences.	-0.112	0.658	0.332	0.065	0.331	0.475
I have re-appraised people's willingness to help others.	-0.192	0.620	0.185	0.169	0.295	0.402
I started thinking about the mission of my life.	0.013	0.612	0.282	-0.046	0.130	0.434
I have a courage that beats my fate.	-0.072	0.600	-0.007	0.071	0.292	0.398
I have gained some valuable experiences during EQ.	-0.208	0.412	0.210	0.256	0.096	0.264
I think that I have changed after EQ.	0.080	0.234	0.818	-0.224	0.349	0.740
I think that my life changed after EQ.	0.120	0.194	0.806	-0.301	0.216	0.700
I use EQ as a time boundary when talking about my life.	0.087	0.065	0.718	0.052	-0.082	0.592
I feel normal about my daily life.	-0.124	0.153	-0.140	0.850	0.146	0.730
I feel that everyday is a repetition of routine things.	0.049	-0.009	-0.094	0.749	-0.059	0.593
I have a good prospect on my daily life	-0.166	0.204	-0.138	0.713	0.269	0.562
Myself has changed toward a positive direction after EQ.	-0.251	0.353	0.257	0.106	0.872	0.783
My life has changed toward a positive direction after EQ.	-0.267	0.330	0.049	0.160	0.866	0.766
Eigenvalues	4.574	2.980	2.194	1.453	1.180	
Variance Accounted For (%)	20.8%	13.5%	10.0%	6.6%	5.4%	

Table 6. 2005 study factor analysis results of 13 recovery curve and 5 life change appraisal model items (promax rotation).

Items	Struggle for Meaning	Retreat	Sense of Life Change	Return to Normalcy	Life Change Direction	Communality
I feel strongly that living a life has a meaning.	0.800	-0.108	0.115	0.134	0.272	0.650
I think that there is a meaning in my life.	0.789	-0.145	0.063	0.119	0.235	0.647
I have re-appraised people's willingness to help others.	0.689	-0.092	0.094	0.195	0.282	0.490
I have emotionally grown thanks to EQ experiences	0.687	-0.120	0.299	0.133	0.397	0.540
I started thinking about the mission of my life.	0.672	0.078	0.399	-0.084	0.137	0.523
I have gained some valuable experiences during EQ.	0.453	-0.222	0.187	0.365	0.067	0.371
I don't want to be asked about my EQ experiences	-0.106	0.872	0.116	-0.062	-0.181	0.764
I don't want to recall EQ episodes.	-0.113	0.855	0.119	-0.150	-0.227	0.734
I don't want to listen to EQ stories	-0.130	0.850	0.109	-0.047	-0.141	0.732
I want to erase EQ experiences from my past.	-0.025	0.733	0.151	-0.135	-0.296	0.567
I think that I have changed after EQ.	0.260	0.158	0.878	-0.225	0.165	0.788
I think that my life changed after EQ.	0.205	0.205	0.850	-0.252	0.113	0.741
I use EQ as a time boundary when talking about my life.	0.098	0.053	0.760	-0.073	-0.086	0.628
I feel normal about my daily life.	0.168	-0.104	-0.274	0.820	0.292	0.713
I feel that everyday is a repetition of routine things.	0.047	0.038	-0.178	0.760	-0.066	0.635
I have a good prospect on my daily life	0.121	-0.174	-0.037	0.703	0.323	0.547
My life has changed toward a positive direction after EQ.	0.298	-0.203	0.024	0.222	0.886	0.790
Myself has changed toward a positive direction after EQ.	0.352	-0.286	0.117	0.185	0.882	0.790
Eigenvalues	3.875	3.112	2.098	1.337	1.154	
Variance Accounted For (%)	21.5%	17.3%	11.7%	7.4%	6.4%	

Table 7. 2003 study second-order factor analysis results of 5 factors (promax rotation).

First-order Factors	Event Evaluation	Event Impact	Communality
Struggle for Meaning	0.789	0.055	0.629
Life Change Direction	0.784	0.015	0.617
Retreat	-0.534	0.474	0.493
Sense of Life Change	0.267	0.740	0.633
Return to Normalcy	0.150	-0.668	0.463
Eigenvalues	1.621	1.214	
Variance Accounted For (%)	32.4%	24.3%	

Table 8. 2005 study second-order factor analysis results of 5 factors (promax rotation).

First-order Factors	Event Evaluation	Event Impact
Struggle for Meaning	0.803	-0.102
Life Change Direction	0.632	-0.418
Sense of Life Change	0.629	0.620
Return to Normalcy	0.089	-0.682
Retreat	-0.165	0.628
Eigenvalues	1.611	1.302
Variance Accounted For (%)	32.2%	26.0%

indicated an over time stability of the five factor structure that corresponded to retreat, struggle for meaning, sense of life change, return to normalcy, and life change direction. To examine the super-structure among these five factors, second-order factor analyses were conducted for both study results (Tables 7 and 8), showing that the five factors integrated into two second-order factors, and were interpreted as event evaluation and event impact. The 2003 study second-order factor analysis showed event evaluation was reflected by such first-order factors as struggle for

meaning, life change direction, and retreat, while event impact was characterized by a sense of life change, return to normalcy, and retreat (Table 7). The 2005 study second-order factor analysis yielded a similar factor structure where struggle for meaning and life change direction characterized event evaluation while return to normalcy and sense of life change exhibited a core characteristic of event impact (Table 8). These patterns were identical to 2003 results.

The above integrative analysis implied two different

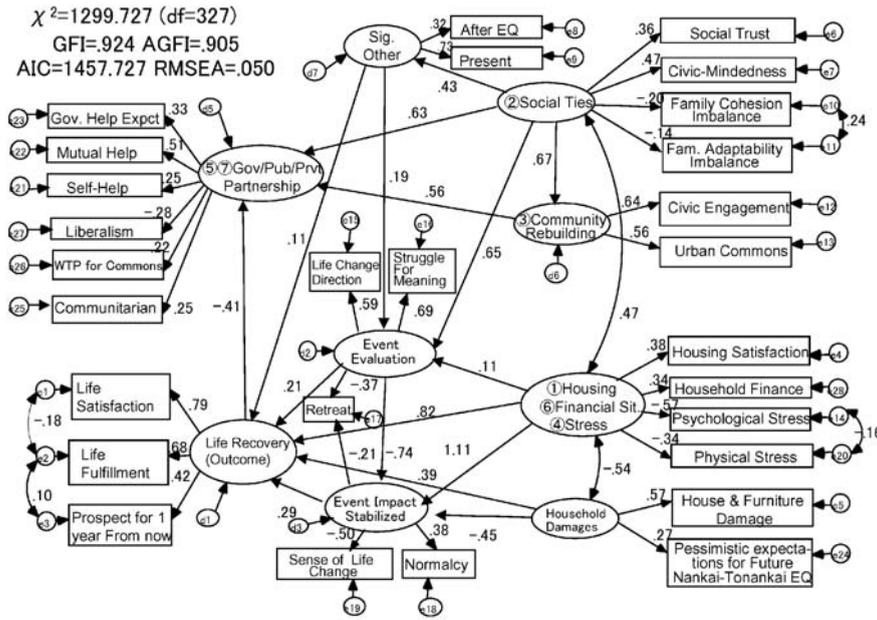


Fig. 8. 2003 SEM path diagram of long-term life recovery process.

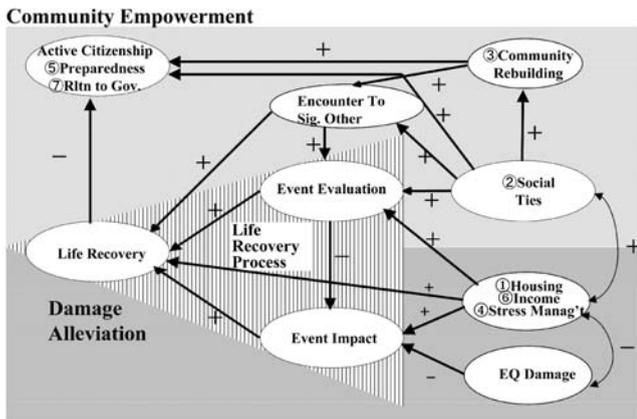


Fig. 9. Bird's-eye-view of life recovery process: 2003 study results (N=1,203, Jan. 2003).

elements, life recovery processes (i.e., event impact and evaluation), and outcome variables. Variables in squares are designated as observed measures obtained from data, while those in ovals are latent variables or postulated constructs (e.g., seven critical elements) that explain high correlations among measures of the same construct. Both 2003 and 2005 studies showed a high overall fit between the model and data; GFI=.924, AGFI=.905, RMSEA=.05 for the 2003 study and GFI=.934, AGFI=.921, RMSEA=.041 for the 2005 study. Estimated parameters or coefficients in both models were all statistically significant at a pre-established $p<.05$ level.

Figures 9 and 11 show bird's-eye-view summaries of 2003 and 2005 study results showing major causal relations among latent variables. Both supported the idea that two different processes, damage alleviation and community empowerment, influenced life recovery outcomes.

Event Impact. Based on preceding exploratory factor analysis, a latent variable – event impact – was postulated as an intermediary process to alleviate the impact of damage and stress upon life recovery. In this process, life recovery was directly caused by the degree to which event impact was stabilized (Figs. 9 and 11). Event impact was measured by such life recovery process variables as a sense of life no longer in transition, a sense of normalcy, and no need for retreat (Figs. 8 and 10).

In the 2003 study (Figs. 8 and 9), event impact stabilization was negatively influenced by the magnitude of household earthquake damage and positively influenced by improvements in the three critical elements of housing, financial situation, and physical

processes or paths toward life recovery – one through alleviating or counteracting the event impact caused by 1995 earthquake damage and loss and the other through event evaluation where earthquake experience was reappraised as meaningful. These implications were based on exploratory analysis of 2003 and 2005 study data. Causal analysis confirmed the internal validity of these postulations on life recovery processes.

4.2.2. Structural Equation Modeling of Life Recovery Process and Outcome

Figures 8 and 10 show the results of structural equation modeling (or SEM) of 2003 and 2005 study data. Results are summarized as path diagrams that signify causal directions (arrows) and their magnitude (standardized coefficients) among damage, seven critical

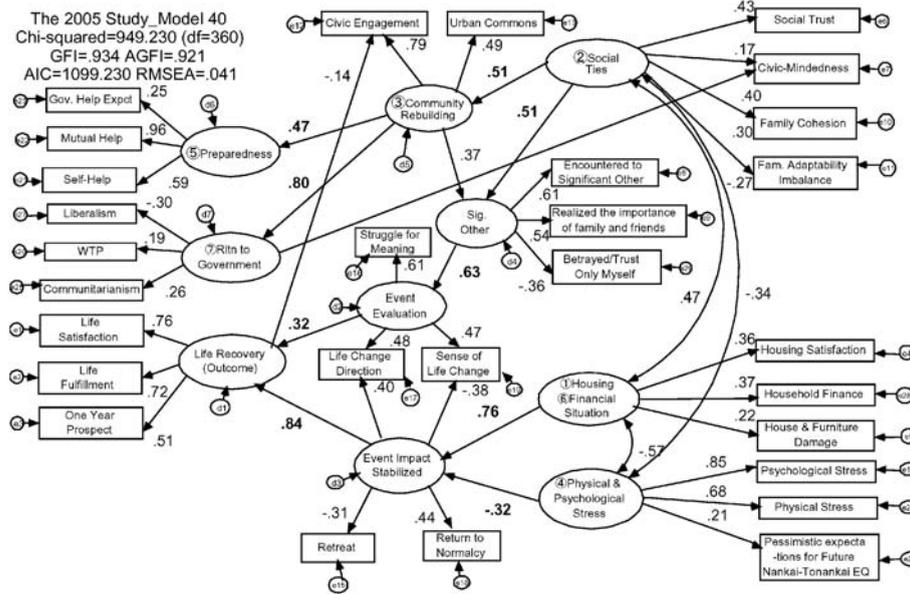


Fig. 10. 2005 SEM path diagram of long-term life recovery process.

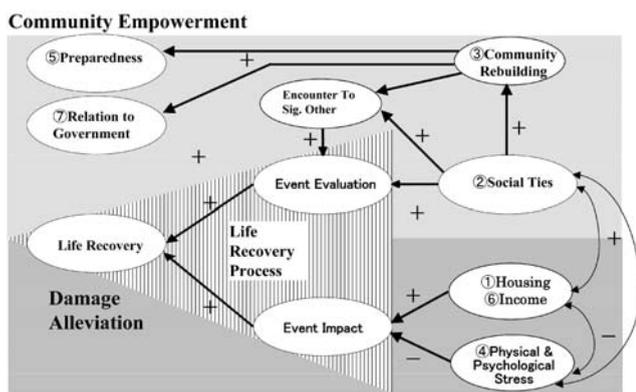


Fig. 11. Bird's-eye-view of life recovery process: 2005 study results (N=1,028, Jan. 2005).

and psychological stress. In other words, when improvements outweighed damage, event impact was stabilized, eventually leading to a sense of life recovery. The 2005 study (Figs. 10 and 11) supported the above causal path in general. A slight but noteworthy difference was that event impact stabilization was determined only by housing and financial situations on the one hand and physical and psychological stress on the other. This was because the direct 1995 earthquake hazard effect as measured by house, furniture, or economic damage disappeared in the 2005 study. People were not suffering because they were hit by an earthquake a decade earlier but suffered from secondary effects such as lack of housing/finance adjustment and/or long lasting physical and psychological stress.

In 2003 study, life recovery was directly influenced by the housing-finance-stress critical element latent

variable. It influenced event evaluation as discussed below. Note that these direct effects failed to be confirmed in the 2005 study, suggesting that these effects were temporary and considered peculiar to 2003 study data.

Community Empowerment. Both 2003 and 2005 studies showed that event evaluation, another construct postulated by the preceding exploratory analysis, played an important intervening role in the community empowerment process. This was another path that led to life recovery (Figs. 8 and 9). The two studies identified a common community empowerment path where a sense of life recovery was achieved through positive event evaluation. This was measured by such attempts and feelings as struggle for meaning, e.g., “I feel strongly that living has a meaning,” positive life change, and low need for retreat (path diagram, Figs. 6 and 7). Social ties, as evidenced by high social trust, civic-mindedness, and balanced family relationships, exerted an influence in such a way that respondents’ evaluation of the earthquake experience was reframed into positive narratives. Influence paths were both direct and indirect. Indirect were through empowering community building efforts and/or increasing opportunities to encounter significant others who provided social and psychological support for re-socialization to and reconstruction of post-earthquake reality (Berger and Luckman, 1966 [32]; Mead, 1963 [38]).

Active Citizenship. Social ties were found in both 2003 and 2005 studies to increase a sense of active citizenship and government/community/private-sector partnership. This was considered as a separate by-product of life recovery processes (Figs. 9 and 11). Active citizenship was demonstrated by high self- and

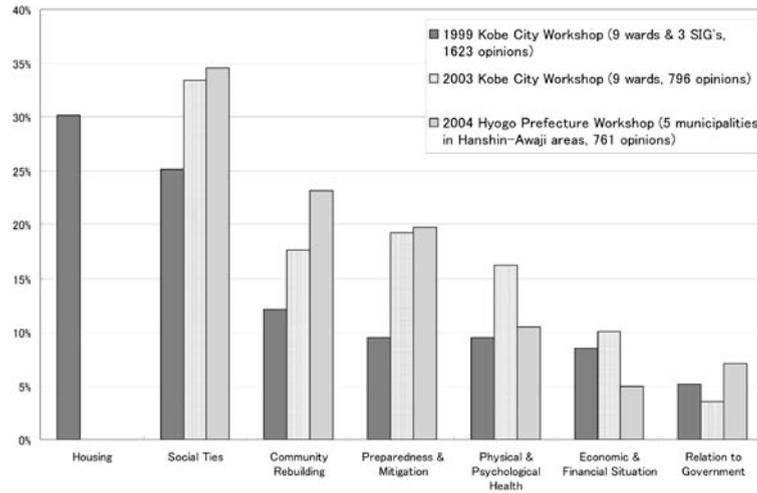


Fig. 12. Proportion of life recovery elements in 1999, 2003 and 2004 workshops.

community-help preparedness initiatives and by a rise in communitarianism (“We govern ourselves by our own hands.”) as opposed to more individualistic liberalism orientation (“The less the interference from the government, the better government we have.”). In the 2003 study, preparedness and relation-to-government variables were amalgamated but conceptually separated in the 2005 study. Otherwise, the same interpretation was applicable to both study results: Stronger social ties were responsible for an increase in active citizenship.

In both 2003 and 2005 studies, life recovery outcomes showed a negative impact upon active citizenship and government/community/private-sector partnership, although this relation was more clearly demonstrated in 2003 results. The 2003 SEM analysis spotted a downward trend that made people less inclined to take communitarian attitudes and pay less attention to preparedness efforts as life recovered (**Fig. 9**). As in the 2003 study, 2005 SEM analysis identified a similar negative effect of life recovery upon civic engagement activities. Unlike in the 2003 study, a communitarian view of government was found to strengthen the norm of civic-mindedness (**Fig. 10**). This appears to suggest that although civic activity decreases, a sense of civic-mindedness emerging over post-earthquake years was internalized within the value systems of surveyed respondents. If another occasion should arise, civic-mindedness would be reactivated into civic engagement.

5. Discussion

5.1. 2003 and 2004 Grassroots Assessment of Life Recovery

Tatsuki (2004) [5] reported the findings from the 2003, and 2004 grassroots assessment workshops on life recovery. These workshops were designed as a part of a ten-year overall review of social recovery after the 1995

Kobe earthquake. The ten-year assessment used the same workshop method as the 1999 assessment. A workshop was held at each of Kobe’s nine wards in 2003, and in four neighboring earthquake-hit cities and in Chuo-ward, Kobe in 2004. The seven critical element category was used to compare three workshop results (**Fig. 12**). The ten year assessments provided an opportunity to cross-examine the external validity of Life Recovery Survey findings.

One of the most striking findings in the 2003 and 2004 workshops was the disappearance of housing that had been listed as one of the most critical issues in 1999 workshops. Note that the last occupant of a temporary housing unit returned the house key to officials at the end of 1999 in Kobe. This was thanks to about 300 public housing complexes being built within five years after the 1995 earthquake and supplying more than 46,000 units (Koshiyama et al. 2003 [39]). Likewise, major house repairs and reconstruction were completed within the same time scale (see Kimura article in this issue). This appears to suggest that people were just about to finish dealing with house damage when the 1999 grassroots assessment was conducted and that housing was felt as one of the timeliest and the most talked-about critical elements for life recovery among workshop participants at the time.

Social ties, the second most talked-about critical element for life recovery in the 1999 workshops, remained the top priority at both 2003, and 2004 assessment workshops. A rise in the proportion of opinions from 1999 workshops was seen both in social ties and in the next two critical elements, community rebuilding and preparedness. This suggested that far more emphasis was placed on these life recovery elements almost ten years after the Kobe earthquake. A rise was also seen in physical and psychological health at the 2003 assessment in Kobe, hardest hit by the earthquake. This rise was mainly due to an increase in

opinions about its subcategory “struggle for meaning” (Fig. 4, subcategories within critical elements). Examples include “The earthquake changed my view of life,” “My values changed,” “I feel a sense of obligation to keep memories alive and to share them with new generations of people.”

The life recovery process and outcome model (e.g., Figs. 9 and 11), as seen in the 2003, and 2005 Hyogo Life Recovery Studies, explains the rise in opinions in such categories as social ties, community rebuilding, preparedness, and physical and psychological health. A process of event evaluation continued being active among the 2003 and 2004 workshop participants. Event evaluation consisted of such variables as struggle for meaning and a sense of positive life change. This process was facilitated by empowered social ties and community rebuilding efforts and led to a sense of life recovery and to more civic engagement in preparedness. The disappearance of housing as an issue is explained by the same model. The process of event impact peaked during 1999 workshops, mainly due to high satisfaction with housing, leading to a sense of life recovery at this time. Toward the end of the decade after the earthquake, repaired or reconstructed homes became a part of normal everyday life, and housing was no longer associated with life recovery. Note that proportionately almost the same number of opinions was found in economic and financial situations as a critical element for life recovery particularly among Kobe residents. This may suggest the importance of household and local economy improvement in further alleviating the impact of the 1995 earthquake.

5.2. Policy Implications for Long-term Life Recovery from Urban Mega-disasters

The current paper examined what constitutes “life recovery,” what facilitates it, and how it is facilitated over the long-term. The study resulted in a grassroots-assessment-based working model (the seven critical element model of life recovery), which was then tested, validated, and further refined by a series of empirical studies. The life recovery process and outcome model, the final product of these research endeavors, provides a framework for life recovery assistance programs and policies for future urban mega-disaster victims/survivors.

At an earlier course of life recovery (i.e., within five years), housing, income, and physical and psychological health management issues should be addressed to alleviate event impact. This leads to a sense of normalcy and stability in everyday life. Policies and programs geared toward this objective include provisions of many different types of temporal and permanent housing units, grants and low interest loans, and other housing related programs, monetary compensation and grants for livelihood assistance, and public health care services including stress management programs.

Apart from damage alleviation, another and possibly

longer-term life recovery process, event evaluation, was identified. This process was found to be directly facilitated by social ties in which disaster experience was reframed into complete, coherent, meaningful narratives. Social ties also indirectly influenced event evaluation by empowering community rebuilding efforts and/or through enriching opportunities to encounter significant others who assisted in re-socialization to and reconstruction of post-earthquake realities. Policies and programs for event evaluation should include family and community enrichment/empowerment and commemoration and transcending of the experience and its communication, together with its lessons, to the next generation.

In addition to life recovery, community empowerment produces a norm for a government/community/private-sector partnership and civic engagement in arenas such as preparedness and local governance. Although life recovery outcomes negatively affect levels of civic activities over time, the newly emerged norm of civic engagement remained even a decade after the earthquake. The concept of civil society became a reality as a by-product of social recovery. Policy makers and administrators must thus consider this window of opportunity as an asset for creation of a better and just post-recovery society.

References:

- [1] Y. Kawata, “Urban Mega-Disaster,” Nagoya:Kin-Mirai-Sha, 1995 (in Japanese).
- [2] S. Tatsuki and H. Hayashi, “Family system adjustment and adaptive reconstruction of social reality among the 1995 earthquake survivors,” *International Journal of Japanese Sociology*, 9, pp. 81-110, 2000.
- [3] S. Tatsuki and H. Hayashi, “Comprehensive Assessment of Life Recovery Utilizing the Total Quality Control Method: Grassroots assessment and Construction of Bird’s Eye View of Life Recovery,” *Urban Policy*, 104, pp. 123-141, 2001 (in Japanese).
- [4] S. Tatsuki, H. Hayashi, K. Yamori, T. Noda, K. Tamura, and Reo Kimura, “Model Building and Testing of Long-Term Life Recovery Processes of the Survivors of the 1995 Kobe earthquake: Structural Equation Modeling (SEM) of the 2003 Hyogo Prefecture Life Recovery Survey,” *Journal of Institute of Social Safety Science*, 6, pp. 251-260, 2004 (in Japanese).
- [5] S. Tatsuki, “The Current Status of Self-governance and Solidarity in Kobe,” *Urban Policy*, 116, pp. 88-105, 2004 (In Japanese).
- [6] K. Shigekawa and H. Hayashi, “A study of disaster process as viewed from disaster responders’ perspectives: The Kobe earthquake case study,” *Proceedings of the 7th Annual Conference of the Institute of Social Safety Science*, 370-375, 1997 (in Japanese).
- [7] F. Aono, S. Tanaka, H. Hayashi, K. Shigekawa, and M. Miyano, “A Study of Disaster Victims’ Response Behavior during the Hanshin-Awaji Great Earthquake: A Nishinomiya City Case Study,” *Proceedings of the 8th Annual Conference of the Institute of Social Safety Science*, pp. 36-39, 1998 (in Japanese).
- [8] M. Takashima and H. Hayashi, “Spacio-Temporal Patterns of Recovery Process under Large Earthquake Disaster: A Case Study for Hanshin-Awaji Earthquake,” *Journal of Institute of Social Safety Science*, 1, pp. 1-8, 1999 (in Japanese).

- [9] Y. Karatani, H. Hayashi, and Y. Kawata, "Development of Socioeconomic Rehabilitation Index based on Kobe Statistics for the Great-Hanshin-Awaji Earthquake Disaster," *Journal of Institute of Social Safety Science*, 2, pp. 213-222, 2000 (in Japanese).
- [10] G. Webb, K. Tierney, and J. Dahlhamer, "Businesses and Disasters: Empirical Patterns and Unanswered Questions," *Natural Hazards Review*, 1, pp. 83-90, 2000.
- [11] D. Alesch, J. N. Holly, E. Mittler, and R. Nagy, "When small businesses and not-for-profit organizations collide with natural disasters," Paper presented at the 26th Annual Hazard Research and Applications Workshop, Boulder, Colorado, July, 2001.
- [12] D. Alesch, "A quantitative and qualitative analysis of small organization survival and recovery following a natural hazard event." A session summary (recorded by C. L. Reiss), the 2001 Hazards Research and Applications Workshop. <http://www.colorado.edu/hazards/ss/ss01/s35.html>, 2001
- [13] D. Alesch and J. N. Holly, "Long-term Community Disaster Recovery: Managing in the Aftermath," VA:Public Entity Risk Institute (in press).
- [14] D. Wenger, C. B. Rubin, J. Nigg, P. Berke, and T. Bolton, "S96-4 What is Known and Trends for Improving Recovery and Reconstruction Following Disasters," A session Summary (recorded by C. Streeter), the 1996 Hazards Research and Applications Workshop, 1996. <http://www.colorado.edu/hazards/ss/ss96.html#4>
- [15] S. Tanaka, F. Aono, and H. Hayashi, "Disaster victims behavior analysis after the Hanshin-Awaji earthquake disaster," the Proceedings of the 3rd China-Japan-US Trilateral Symposium on Lifeline Earthquake Engineering, pp. 309-314, 1998.
- [16] S. Tanaka, H. Hayashi, and K. Shigekawa, "A Consideration on Time-series Development of Disaster Process Based on Ethnographic Study of Disaster Victims' Responses," *Journal of Japan Society for Natural Disaster Science*, 18-1, pp. 21-29, 1999 (in Japanese).
- [17] D. H. Olson, D. H. Sprenkle, and C. S. Russell, "Circumplex Model of Marital and Family Systems: Cohesion and Adaptability Dimensions, Family Types, and Clinical Applications," *Family Process*, 18, pp. 3-28, 1979.
- [18] S. Tatsuki, "Theoretical and empirical study of family system: Validation of Olson's Circumplex model of marital and family systems," Tokyo: Kawashima Shoten, 1999 (in Japanese).
- [19] J. J. Rousseau, "The Social Contract or Principles of Political Right," (G. D. H. Cole, Trans.), 1913/1762. <http://www.constitution.org/jjr/socon.htm>
- [20] G. Kline, "Democracy, Community, and Human Development," *Journal of Third World Studies*, 11-1, pp. 224-244, 1994.
- [21] D. Burchell, "The Attributes of Citizens: Virtue, Manners and the Activity of Citizenship," *Economy and Society*, 24-4, pp. 540-558, 1995.
- [22] H. Hayashi, M. Nishio, K. Sugawara, I. Monma, M. Kohno, T. Makishima, K. Numata, and Y. Nemoto, "Research Report on Mental Health Responses that are Needed for Life Support of Elderly Victims after a Large Scale Disaster," Tokyo: Japan Red Cross, 1996 (in Japanese).
- [23] S. Nishisato, "Analysis of categorical data: Dual scaling and its Applications," Toronto: University of Toronto Press, 1980.
- [24] Kobe City Research Committee on Disaster Recovery, "Kobe City's Review for Individual Recovery," Kobe City, 2000.
- [25] T. Yamagishi, "Structure of Trust," Tokyo:University of Tokyo Press, 1998 (in Japanese).
- [26] R. M. MacIver, "Community – A Sociological Study," 3rd Edition, London:Macmillan, 1924.
- [27] A. Tamura, "Practice of Community Development," Iwanami-shinsho, 1999 (in Japanese).
- [28] N. Maki, H. Hayashi, S. Tatsuki, and M. Takashima, "Structure of Recovery Processes from the 1995 Kobe Earthquake: A summary of findings from the 5th year review by Kobe city government," Proceedings of International Workshop on Annual Commemoration of Chi-Chi Earthquake, Volume IV Social Aspect, pp. 210-221, 2000.
- [29] N. B. Belloc and J. Breslow, "Relationship of physical health status and health practices," *Internal Prev. Med*, 1, pp. 409-421, 1972.
- [30] M. Okamoto, "Civil society, volunteers, and government," In S. Tatsuki (Ed.), "Volunteerism and Civil Society," Kyoto:Koyo Shobo, 1997 (in Japanese).
- [31] T. Oguchi (Ed.), "A Study on International Questionnaire Scales MMPI-2 and MMPI-A," KN Publisher, 2001.
- [32] P. L. Berger and T. Luckman, "The Social Construction of Reality: A Treatise in the Sociology of Knowledge." NY: Doubleday, 1966.
- [33] V. E. Frankl, "Man's Search for Meaning," NY: Pocket Books, 1959.
- [34] R. J. Lifton, "Death in Life: The Survivors of Hiroshima," NY: Random House, 1967.
- [35] E. Kubler-Ross, "On Death and Dying" NY:Simon & Schuster/Touchstone, 1969.
- [36] S. Tatsuki and H. Hayashi, "Seven Critical Element Model of Life Recovery: General Linear Model Analyses of the 2001 Kobe Panel Survey Data," Proceedings of the 2nd Workshop for "Comparative Study on Urban Earthquake Disaster Management," pp. 27-46, 2002.
- [37] K. Tamura, H. Hayashi, S. Tatsuki, and R. Kimura, "A quantitative verification of the seven elements model of socio-economic recovery from the Kobe earthquake," *Journal of Institute of Social Safety Science*, 3, pp. 33-40, 2001 (in Japanese).
- [38] G. H. Mead, "Mind, Self and Society from the Standpoint of a Social Behaviorist (Works of George Herbert Mead)," IL:Univ of Chicago Press, 1963.
- [39] K. Koshiyama, S. Tatsuki, I. Kobayashi, Y. Murosaki, et. al., "Analysis of Sense of Recovery of Residents Living in Disaster Recovery Public Housing," *Journal of Institute of Social Safety Science*, 3, pp. 237-244, 2003.
- [40] J. M. Dahlhamer and K. J. Tierney, "Winners and Losers: Predicting Business Disaster Recovery Outcomes Following the Northridge Earthquake," Disaster Research Center, University of Delaware, Newark, N.J., 1996.
- [41] R. Kimura, H. Hayashi, S. Tatsuki, and K. Tamura, "Determinants and Timing of Housing Reconstruction Decisions by the Victims of the 1995 Hanshin-Awaji Earthquake Disaster: A 2001 Replication," *Journal of Institute of Social Safety Science*, 3, pp. 23-32, 2001 (in Japanese).



Name:
Shigeo Tatsuki, Ph.D.

Affiliation:
Professor, Department of Sociology, Doshisha
University

Address:

Kamigyo-ku, Kyoto 602-8580, Japan

Brief Career:

1986-2001 Lecturer, Assistant Professor, Professor, Kwansai Gakuin
University

2001- Professor, Doshisha University

2002- Senior Research Scientist, Disaster Reduction and Human
Renovation Institution

Selected Publications:

S. Tatsuki, and H. Hayashi, "Family system adjustment and adaptive
reconstruction of social reality among the 1995 earthquake survivors,"
International Journal of Japanese Sociology, 9, pp. 81-110, Oct. 2000.

S. Tatsuki, et al., "The Impact of Risk Perception, Disaster Schema,
Resources, Intention, Attitude, and Norms upon Risk Aversive Behavior
among Marikina City Residents: Structural Equation Modeling with
Latent Variables," Asian Conference on Earthquake Engineering
Technical Proceedings, 2, pp. 267-276, Mar. 2004.

S. Tatsuki, "Development of Disaster Response Competency Profile
Indices," Proceedings of the 2nd International Conference on Urban
Disaster Reduction, CD-ROM, Nov. 2007.

Academic Societies & Scientific Organizations:

Institute of Social Safety Science

The Japan Sociological Society

Japan Society for Natural Disaster Science
